

United States Patent [19]

Kobayashi

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[54] AIR CONDITIONER

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[58] Field of Search 236/44 C; 98/2.11; 62/90, 176.5, 244; 165/42, 43; 261/DIG. 34

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[57] ABSTRACT

A first air conditioner is generally applied to a vehicle including a windshield and a passenger compartment having a front segment and a rear segment. The windshield faces the front segment of the passenger compartment. Air is injected into the front segment of the passenger compartment via a first duct. Air is injected into the rear segment of the passenger compartment via a second duct. A humidifier acts on the air injected into the rear segment of the passenger compartment via the second duct. In a second air conditioner, a humidifier can be selectively activated and deactivated. A temperature control arrangement responsive to activation and deactivation of the humidifier compensates for fluctuations in the temperature of air resulting from changes between activated and deactivated states of the humidifier.

8 Claims, 17 Drawing Figures

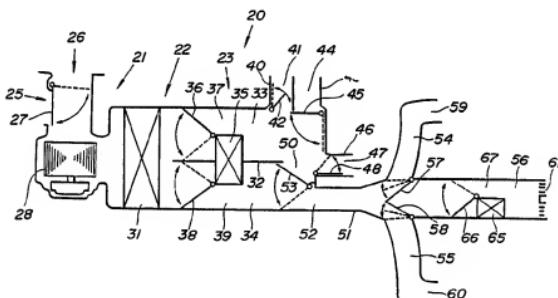
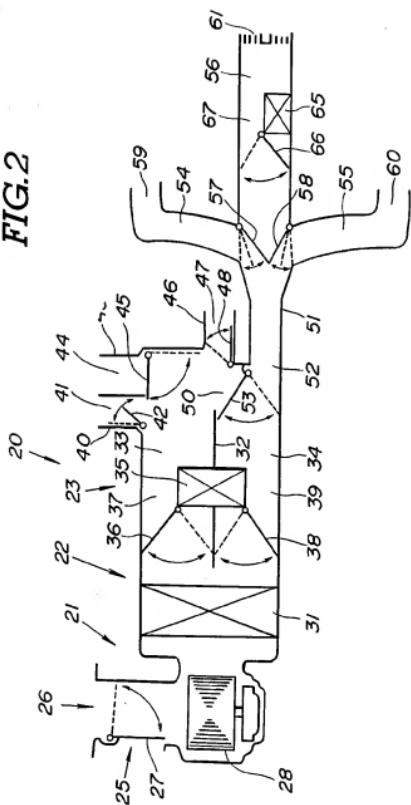


FIG. 2



pivotable separation door 53 disposed within the heating unit 23 blocks and unblocks the communication opening 50 and the inlet 52 of the duct 51. When the separation door 53 unblocks the communication opening 50 and blocks the inlet 52 of the duct 51, air moves from the second heating unit passage 34 into the outlets 41, 44, and 47 via the communication opening 50 and then enters the front segment of the interior or the passenger compartment of the vehicle. In this case, all of the air which has passed through both the first and second passages 33 and 34 within the heating unit 23 is injected into the front segment of the interior or the passenger compartment of the vehicle. When the separation door 53 blocks the communication opening 50 and unblocks the inlet 52 of the duct 51, air moves from the second heating unit passage 34 to the duct 51 and then enters the rear segment of the interior or the passenger compartment of the vehicle. In this case, air which has passed through the first heating unit passage 33 is injected into the front segment of the interior or the passenger compartment of the vehicle while air which has passed through the second heating unit passage 34 is injected into the rear segment of the interior or the passenger compartment of the vehicle.

The duct 51 trifurcates into three sub-ducts 54, 55, 25 and 56 at a point downstream of the inlet 52. A pair of pivotable mode change doors 57 and 58 linked to each other and disposed within the duct 51 blocks and unblocks these sub-ducts 54, 55, and 56. When the mode change doors 57 and 58 unblock the first and second sub-ducts 54 and 55 but block the third sub-duct 56, air which has entered the duct 51 via the inlet 52 moves into the first and second sub-ducts 54 and 55 and then exits from the sub-ducts 54 and 55 via rear foot outlets 59 and 60 defined by the downstream ends of the sub-ducts 54 and 55 respectively. The first outlet 59 generally directs outgoing air toward the feet of passengers on the right-hand side of the vehicle rear seat. The second outlet 60 generally directs outgoing air toward the feet of passengers on the left-hand side of the vehicle 40 rear seat. When the mode change doors 57 and 58 block the third duct 56, air which has entered the duct 51 via the inlet 52 moves into the third sub-duct 56 and then exits from the sub-duct 56 via a rear ventilator outlet 61 45 defined by the downstream end of the sub-duct 56. This outlet 61 generally directs outgoing air toward the breast of passengers on the vehicle rear seat. When the mode change doors 57 and 58 partially unblock all the sub-ducts 54, 55, and 56, air moves into these sub-ducts 54, 55, and 56 and then enters the rear segment of the interior or the passenger compartment of the vehicle via the outlets 59, 60, and 61.

A humidifier 65 has an inlet and an outlet opening into the third sub-duct 56. As air passes through the 55 humidifier 65 between its inlet and outlet, it is humidified. A pivotable humidifier control door 66 disposed within the third sub-duct 56 blocks and unblocks the inlet of the humidifier 65. When the humidifier door 66 blocks the inlet of the humidifier 65 but unblocks a passage 67 within the third sub-duct 56 which bypasses the humidifier 65, essentially all of the air which has entered the third sub-duct 56 bypasses the humidifier 65 via the bypass passage 67. In this case, the humidifier 65 does not affect the humidity of air exiting from the 60 sub-duct 56 via the rear ventilator outlet 61. When the humidifier door 66 unblocks the inlet of the humidifier 65 but blocks the bypass passage 67, essentially all of the

air which has entered the third sub-duct 56 moves into the inlet of the humidifier 65 and then flows through the humidifier 65, exiting from the humidifier 65 and returning to the sub-duct 56 via the outlet of the humidifier 65.

5 In this case, the humidifier 65 has a maximal effect on the humidity of air exiting from the sub-duct 56 via the rear ventilator outlet 61.

The humidifier 65 may include a water atomizer having an injection nozzle designed to spray water directly into the third sub-duct 56. In this case, the door 66 is omitted. In addition, the humidifier 65 is activated and deactivated by energizing and de-energizing an electrically-powered pump driving water or a combination of water and air to the spray nozzle.

As shown in FIG. 1, the third sub-duct 56 passes through a central console box 68. The rear ventilator outlet 61 is mounted on the rear face of the console box 68. A major part of the humidifier 65 resides within the console box 68. This disposition of the humidifier 65 prevents any loss of free space within the vehicle passenger compartment.

A rear defroster or defogger 70 mainly serves to prevent the vehicle rear window from fogging.

As shown in FIG. 3, the air conditioner includes a temperature sensor 100 generating a signal S1 representing the temperature of air outside the vehicle, that is, the atmospheric temperature.

A temperature sensor 101 generates a signal S2 representing the temperature of air within the vehicle passenger compartment.

A light sensor 102 generates a signal S3 representing the intensity of sunshine on the vehicle.

A temperature sensor 103 generates a signal S4 representing the temperature of air drawn into the blower unit 21.

A control unit 130 includes a sensor input circuit 104 receiving the signals S1-S4 and generating a multiplexed signal S5 selected from among these signals S1-S4.

A front manual setting section 105 includes switches and a potentiometer supported by a front control panel. The switches generate signals representing selected control modes of the air conditioner. The potentiometer generates a signal representing a selected target temperature of air within the front segment of the vehicle passenger compartment.

The control unit 130 includes a front setting input circuit 106 receiving the signals from the manual section 105 and generating a multiplexed signal S6 which represents the selected control mode of the air conditioner and the selected target temperature of air within the front segment of the vehicle passenger compartment.

A rear manual setting section 107 includes switches and a potentiometer supported by a rear control panel as will be described in detail hereinafter. The switches generate signals representing selected control modes of rear air conditioning. The potentiometer generates a signal representing a selected target temperature of air within the rear segment of the vehicle passenger compartment.

FIG. 4 shows the rear control panel 180, which has a slot 181 through which a manual lever 182 slidably extends. The lever 182 is connected to an adjustment arm of the potentiometer generating the signal S20 representing the target temperature of air within the rear segment of the vehicle passenger compartment. The target temperature varies in accordance with the position of the lever 182. A manual rear air conditioning